

# In-Hospital Electrocardiographic (ECG) Telemetry Monitoring for Acute Heart Failure: A Rapid Review

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# List of Abbreviations

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<b>AHA</b>	American Heart Association
<b>CCS</b>	Canadian Cardiovascular Society
<b>ECG</b>	Electrocardiography
<b>ESC</b>	European Society of Cardiology
<b>HF</b>	Heart failure
<b>HFSA</b>	Heart Failure Society of America
<b>RCT</b>	Randomized controlled trial

# Background

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As legislated in Ontario's *Excellent Care for All Act*, Health Quality Ontario's mandate includes the provision of objective, evidence-informed advice about health care funding mechanisms, incentives, and opportunities to improve quality and efficiency in the health care system. As part of its Quality-Based Funding (QBF) initiative, Health Quality Ontario works with multidisciplinary expert panels (composed of leading clinicians, scientists, and administrators) to develop evidence-based practice recommendations and define episodes of care for selected disease areas or procedures. Health Quality Ontario's recommendations are intended to inform the Ministry of Health and Long-Term Care's Health System Funding Strategy.

For more information on Health Quality Ontario's Quality-Based Funding initiative, visit [www.hqontario.ca](http://www.hqontario.ca).

## Objective of Analysis

The objective of this analysis was to determine the effectiveness of electrocardiography (ECG) telemetry monitoring among patients hospitalized for acute heart failure (HF).

## Clinical Need and Target Population

Significant variations in cardiac rhythm can occur either as a precursor to, or as a result of, acute HF. In particular, acute HF is a major risk factor for the development of clinically significant ventricular and atrial arrhythmias, which may result in morbidity or cardiac death. (1;2) Additionally, some therapies for acute HF have been shown to exhibit proarrhythmic properties. (3) Early detection of significant variations in cardiac rate and rhythm may facilitate acute HF patient management through early and appropriate therapeutic intervention.

## Technology

Inpatient ECG telemetry monitoring is a noninvasive method that allows for continuous, real-time detection of significant variations in a patient's cardiac rhythm and electrical activity. (4) Telemetry can detect complex dysrhythmias, myocardial ischemia, and prolonged QT-intervals. (4) During inpatient ECG telemetry monitoring, electrocardiographic signals are acquired from electrodes that are attached to the patient's chest and lead wires connected to a telemetry device. (5) The ECG signal is transmitted via radio frequency to a central monitoring station, where health care professionals can continuously monitor patient activity and are alerted to rhythm disturbances. Signals are also received or hard-wired to the patient's bedside monitor display. (5) The number of hospital beds with telemetry monitoring is often limited; the use of this resource among acute HF patients should be appropriately assessed.

# Rapid Review

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## Research Question

What is the effectiveness of ECG telemetry monitoring among patients hospitalized with acute HF in comparison to standard care?

## Research Methods

### Literature Search

A literature search was performed on October 17, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2002, until October 17, 2012. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

### Inclusion Criteria

- English language full-reports
- published between January 1, 2002, and October 17, 2012
- systematic reviews, meta-analyses, health technology assessments, clinical practice guidelines, or randomized controlled trials (RCTs)
- adult acute HF population
- studies evaluating in-hospital ECG telemetry monitoring

### Exclusion Criteria

- observational studies, case reports, editorials
- standard 12-lead ECG or ambulatory ECG monitoring (e.g., Holter monitoring)

### Outcome of Interest

- mortality

### Expert Panel

In August 2012, an Expert Advisory Panel on Episode of Care for Congestive Heart Failure was struck. Members of the panel included physicians, personnel from the Ministry of Health and Long-Term Care, and representation from the community laboratories.

The role of the Expert Advisory Panel on Episode of Care for Congestive Heart Failure was to contextualize the evidence produced by Health Quality Ontario and provide advice on the components of a high-quality episode of care for HF patients presenting to an acute care hospital. However, the statements, conclusions and views expressed in this report do not necessarily represent the views of Expert Advisory Panel members.

## Results of Literature Search

The database search yielded 1,393 citations published between January 1, 2002, and October 17, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment.

No health technology assessments, meta-analyses, systematic reviews or RCTs were identified in the literature search that evaluated ECG telemetry monitoring among an acute HF population.

Four clinical practice guidelines that discussed continuous ECG monitoring for the management of HF in hospital were identified from a hand search of the literature: the 2004 American Heart Association (AHA) Scientific Statement on Practice Standards for Electrocardiographic Monitoring in Hospital Settings; the 2012 European Society of Cardiology (ESC) Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure; the Heart Failure Society of America (HFSA) 2010 Comprehensive Heart Failure Practice Guideline; and the 2007 Canadian Cardiovascular Society (CCS) Consensus Conference Recommendations on Heart Failure. (3;4;6;7) Other guidelines reviewed did not make recommendations regarding real-time ECG telemetry monitoring. Descriptions of the above guidelines and their recommendations related to in-hospital ECG telemetry monitoring or continuous ECG monitoring are provided in Table 1.

**Table 1: Summary of Heart Failure Guidelines Related to Continuous ECG Telemetry Monitoring**

Guideline	Heart Failure Population	Recommendation	Class/Level of Evidence
AHA, 2004 (4)	Acute HF/pulmonary edema	Continuous monitoring is recommended for all patients until the signs and symptoms of acute HF have resolved and cardiac monitoring reveals no hemodynamically significant arrhythmias for at least 24 hours	Class I <sup>a</sup> Expert opinion
	Subacute HF	In the absence of RCTs, it seems reasonable to perform ECG monitoring in the subacute phase of acute HF while medications, device therapy, or both are being manipulated	Class II <sup>b</sup> Expert opinion
ESC, 2012 (6)	Acute HF with hypotension, hypoperfusion, or shock, and IV infusion of an inotrope or vasopressor	ECG should be monitored continuously, because these agents can cause arrhythmias and myocardial ischemia	NA Expert opinion
HFSA, 2010 (3)	Acute decompensated HF plus IV inotrope administration	Administration of IV inotropes (milrinone or dobutamine) should be accompanied by continuous or frequent blood pressure monitoring and continuous monitoring of cardiac rhythm	C <sup>c</sup>
CCS, 2007 (7)	Acute HF	Cardiac arrhythmias should be evaluated by a 12-lead ECG and continuous ECG monitoring.	Unclear <sup>d</sup>

Abbreviations: AHA, American Heart Association; CCS, Canadian Cardiovascular Society; ECG, electrocardiograph(y); ESC, European Society of Cardiology; HF, heart failure; HFSA, Heart Failure Society of America; IV, intravenous; NA, not available; RCT, randomized controlled trial.

<sup>a</sup>Class I: cardiac monitoring is indicated in most, if not all, patients in this group. Includes all patients at significant risk of immediate, life-threatening arrhythmia.

<sup>b</sup>Class II: cardiac monitoring may be of benefit in some patients, but is not considered essential for all patients. ECG telemetry monitoring was considered helpful in the clinical management of Class II patients, but is not expected to save lives. Cardiac monitoring often takes place in an intermediate care (telemetry) unit.

<sup>c</sup>Level C evidence is based on expert opinion.

<sup>d</sup>The comment suggesting ECG monitoring was not directly assessed.



Evidence for the use of ECG monitoring was based largely on expert opinion for all recommendations.

The AHA scientific statement was the only guideline to directly evaluate practice standards for real-time ECG monitoring performed in hospital settings. (4) Electrocardiography monitoring for cardiac arrhythmias was recommended for all acute HF patients, based on evidence surrounding the contribution of arrhythmias to acute cardiac decompensation, and the risk for atrial and ventricular arrhythmias among this population. Monitoring was also considered valuable for patients on intravenous positive inotropic drugs (as they have significant proarrhythmic properties), and during the administration of nesiritide (to detect sinus tachycardia). Whether ECG monitoring should be used for subacute HF was unclear, but was recommended while medications and devices are being manipulated.

Continuous ECG monitoring was recommended in both the ESC and HFSA guidelines for acute HF patients undergoing administration of intravenous inotropes, based on increased risk of arrhythmias and myocardial ischemia. (3;6)

The CCS recommends identification of the precipitating cause of acute HF, evaluating cardiac arrhythmias with a 12-lead ECG and continuous ECG monitoring. (7) However, it is unclear from this guideline whether continuous monitoring refers to inpatient telemetry monitoring.

# Conclusions

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- No high-quality evidence was identified that evaluated the effectiveness of ECG telemetry monitoring among patients with acute HF.
- Based on expert opinion, clinical practice guidelines recommend the use of continuous ECG monitoring among patients with acute HF. The AHA practice standards for in-hospital ECG monitoring and the CCS recommend continuous ECG monitoring among all patients with acute HF. The ESC and HFSA guidelines recommend continuous ECG monitoring among acute HF patients treated with inotropes, based on the increased risk of arrhythmia and myocardial ischemia associated with these agents.

# Acknowledgements

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# Appendices

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## Appendix 1: Literature Search Strategies

Database: Ovid MEDLINE(R) <1946 to October Week 1 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <October 16, 2012>, Embase <1980 to 2012 Week 41>

Search Strategy:

#	Searches	Results
1	exp heart failure/	327674
2	(((cardia? or heart) adj (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) adj (failure or insufficiency))).ti,ab.	258486
3	or/1-2	417506
4	exp *electrocardiography/	107203
5	(electrocardiogram* or ecg* or ekg* or electrocardiograph*).ti,ab.	213410
6	(telemetry adj2 (unit* or cardiac)).ti,ab.	562
7	or/4-6	260511
8	3 and 7	21725
9	Meta Analysis.pt.	36967
10	Meta Analysis/ use emez	66488
11	Systematic Review/ use emez	53812
12	exp Technology Assessment, Biomedical/ use mesz	8872
13	Biomedical Technology Assessment/ use emez	11399
14	(meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or cochrane).ti,ab.	293134
15	((health technolog* or biomedical technolog*) adj2 assess*).ti,ab.	3681
16	exp Random Allocation/ use mesz	76138
17	exp Double-Blind Method/ use mesz	117653
18	exp Control Groups/ use mesz	1376
19	exp Placebos/ use mesz	31442
20	Randomized Controlled Trial/ use emez	330814
21	exp Randomization/ use emez	59725
22	exp Random Sample/ use emez	4238
23	Double Blind Procedure/ use emez	111398
24	exp Triple Blind Procedure/ use emez	35
25	exp Control Group/ use emez	38585
26	exp Placebo/ use emez	206599
27	(random* or RCT).ti,ab.	1385590
28	(placebo* or sham*).ti,ab.	448978
29	(control* adj2 clinical trial*).ti,ab.	38400
30	exp Practice Guideline/ use emez	278889
31	exp Professional Standard/ use emez	269259
32	exp Standard of Care/ use mesz	582
33	exp Guideline/ use mesz	23126
34	exp Guidelines as Topic/ use mesz	102415
35	(guideline* or guidance or consensus statement* or standard or standards).ti.	219538
36	(controlled clinical trial or meta analysis or randomized controlled trial).pt.	456548

37	or/9-36	2979438
38	8 and 37	2607
39	limit 38 to english language	2316
40	limit 39 to yr="2002 -Current"	1627
41	remove duplicates from 40	1275

## Cochrane Library

ID	Search	Hits
#1	MeSH descriptor: [Heart Failure] explode all trees	4862
#2	((cardia? or heart) next (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) next (failure or insufficiency)):ti,ab,kw (Word variations have been searched)	9326
#3	#1 or #2	9331
#4	MeSH descriptor: [Electrocardiography] explode all trees	7189
#5	(electrocardiogram* or ecg* or ekg* or electrocardiograph*):ti (Word variations have been searched)	994
#6	(telemetry adj2 (unit* or cardiac)):ti,ab,kw (Word variations have been searched)	0
#7	#4 or #5	7480
#8	#3 and #7 from 2002 to 2012	294

## CRD

Line	Search	Hits
1	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	510
2	((cardia? or heart) next (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) next (failure or insufficiency)):TI	312
3	#1 OR #2	548
4	MeSH DESCRIPTOR electrocardiography EXPLODE ALL TREES	224
5	((electrocardiogram* or ecg* or ekg* or electrocardiograph*):TI	50
6	(telemetry adj2 (unit* or cardiac)):TI	0
7	#4 OR #5	232
8	#3 AND #7	14
9	(#8):TI FROM 2002 TO 2012	14

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